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Panics and the Disruption of Private Payments Networks: The United States in 1893 and 1907

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The periodic financial crises which hit the United States before the establishment of the Federal Reserve System were often severe enough to occasion collective action on the part of the banking system. In order to relieve pressures on reserves, three times in the postbellum period, 1873, 1893, and 1907, banks in many or most cities declared periods of suspension or restrictions of cash payments at par in which they temporarily restricted or denied altogether the redemption of their deposit liabilities in cash (specie or legal tender notes) (Calomiris and Gorton 1991, pp. 96-100). Friedman and Schwartz (1963, pp. 163-168) have famously contrasted this response to panics under the national banking system (pre-1914) with that in the Great Depression under the Federal Reserve System. In the earlier period restrictions were argued to have mitigated the effects of panics by stopping bank runs. Bank failures, as a consequence, were, if not completely arrested (e.g., see Wicker 2000, pp. 78-80), certainly greatly reduced, thereby damping the rate of monetary contraction.¹ To be sure, they conceded (1963, p. 698) that such restrictions may have caused “severe but brief difficulties,” but with little or no elaboration. Here we consider the downside effects of cash payment restrictions—there was one significant aspect that was not stabilizing, disruptions of the payments system, and it is that element on which this paper focuses.

Modern-day studies of the effects of panics and financial crises have concentrated on the transmission channels of changes in interest rates and/or credit availability (e.g., Mishkin 1996). Recent research in macroeconomics though has raised the possibility that monetary changes might affect the real economy through changes in aggregate supply as well as changes in aggregate demand. Contemporary studies have generally emphasized the impact on investment in working capital (and consequently on the firm's short-run ability to produce), but at a more

¹ These “therapeutic” effects of cash restrictions have been questioned in turn by Dewald (1972) and Timberlake (1984), but on the other hand consider Dwyer and Hasan (2007). We follow Friedman and Schwartz’s terminology of restrictions of cash payments instead of the more common contemporary term of suspension to distinguish it from the temporary closure of particular beleaguered banks.

basic level the “hemorrhaging” of payments networks which delayed the transfer of good funds in settlement of transactions, purchases of labor or commodity inputs, would have had (much more) pronounced real effects through aggregate supply dislocations as well (Barth and Ramey 2002; Christiano, Eichenbaum, and Evans 1997; Christiano and Eichenbaum 1992).

Aggregate supply dislocations could occur for several reasons. One channel described in modern monetary theory is based on the idea that money acts as a social memory device for the economy (Kocherlakota 2000). If there is a disruption in the system by which agents in the economy make long-distance monetary transfers, as occurred during the panics under review, the agents must turn to less well-suited instruments (such as cash transfers) to accomplish the information-tracking task that the drafts and checks performed during normal times. This results in an increase in information costs for producers as the preferred means of transferring and tracking transaction information is out of service. Because of this monetary role of payment systems, a disruption in their operation represents a supply shock.

Serious payments system disruptions are of course still possible in the modern economy. Gridlock, for example, was prevented after the September 11 attacks only through swift and decisive intervention by the Federal Reserve (McAndrews and Potter 2002). But the issue takes on particular relevance for the pre-Federal Reserve period, when both local and non-local transactions were cleared and settled through private payments networks. As we describe in the following section, New York correspondent banks were central in these networks. They constituted the “clearing house of the country” in O.M.W. Sprague’s phrase (1910, p. 126), holding interior banks’ (excess) clearing and secondary reserves. Consequently, payments restrictions especially in New York could significantly reduce access to “good funds” for local and non-local payments and thereby impede normal operations of production and exchange (i.e., reducing liquidity of banks’ clearing and secondary reserves).

In this paper we examine the nature of payments system disruptions in the panics of 1893 and 1907 and their impacts. We focus on these two episodes because of their fundamental

impacts on the payments system. After 1893 New York banks began to assume an even more integral role in mediating long-distance payments and in supplying banks with central-bank like services (Weiman and James 2006). In the aftermath of the 1907 panic the apparent vulnerability of the national payments system to panics and suspensions in New York spawned a reform movement to create the Federal Reserve, which then nationalized the clearing-settlement functions of New York banks.

During panics and cash payment restrictions ready access to New York funds was impeded (i.e., they became less liquid), so we concentrate on dislocations in interior markets for New York funds which in turn interfered with the transferal of balances to meet local or non-local payments needs. Studies of panics have often been limited to just New York banks and financial markets (e.g., Mishkin 1991; Donaldson 1992, 1993)² and/or on the causes and patterns of bank suspensions and failures. Here however we examine the anatomy of the entire network, or at least impacts on regional financial centers, and thus the channels of disruption and propagation. We specify how these shocks disrupt payments networks, in terms of fragmentation and decreased liquidity, and in turn the effects on real economic activity.

Shocks that disrupt payment networks can have effects on broader measures of financial liquidity which today could be observed in bid-ask spreads in financial markets, for example. Empirical evidence shows that various measures of financial market liquidity in the U.S. Treasury bonds as well as in the stock market are reduced during periods of crises; in addition, unexpected injections of money can have positive liquidity effects in these markets (Fleming, 2003; Chordia, Sarkar, and Subrahmanyam 2004). Theoretical work suggests that delayed settlement in the payment system can exacerbate the resolution of uncertainty and credit risks which regular settlement is designed to achieve (Koepl, Monnet, Temzelides 2005). These

² Carlson (2005), who looks at the pattern and causes of suspensions of interior banks in the panic of 1893, and Wicker (2000) are notable exceptions. Tallman and Moen (1995) pay close attention to the course of the panic of 1907 in Chicago.

disruptions caused by the banking crises we study delayed settlements for both financial and real transactions. If the counterparties could not costlessly resort to alternative means of settlement, which we assert they could not do, then real risks and uncertainty in the economy were persisted longer than anticipated, reducing the ability of counterparties to take on new transactions or to extend additional credit.

I. Private Payments Networks

After the demise of the Second Bank of the United States, making payments at a distance posed a difficult problem in a country characterized predominately by independent unit banks with no central monetary authority or integrated nationwide banking system (see Knodell 1998). It could have been accomplished by shipping specie to the payee, but a system of intercity payments involving the physical transfer of cash to settle every transaction would have been a costly one indeed. Unlike the product side, interregional integration of the system of collecting and clearing financial obligations could not be internalized along Chandlerian (1977) lines through the formation of large-scale enterprises, due to the prohibition against branch banking. Monetary integration, then, depended on the formation of a “national” banking system to transfer deposits among banks without corresponding shipments of cash. Instead, independent banks developed two types of private networks to facilitate interbank transactions, local clearing houses and correspondent relationships.

In the 1850s banks in New York, Boston, Philadelphia, and Baltimore formed clearing associations for the collection and clearing of local checks (Cannon 1910; Gorton and Mullineaux 1987). The spatial gap in the payments system between local clearing houses and between city and country banks was filled by the development of the correspondent banking system. Earlier on “country” banks had come to maintain reserve balances routinely in commercial centers, notably Boston and New York, for the redemption of note issues (see Myers 1931; Weber 2003), and by mid-century a system of bank correspondents with New York as a

national center mediating interregional payments had begun to emerge (Bodenhorn 2000, pp. 192-198). The organizational form of these networks of independent banks which developed was a rather novel one, based on longer-term relationships between banks, something between the tighter clubs of urban clearing-houses, which restricted membership and actively monitored operations, and the competitive market.

With intercity or interregional transactions were mostly at the wholesale level, between local merchants and suppliers, for example, New York became the national center for clearing and settling interregional payments. “Tradesmen everywhere have dealings with New York City. There is not a store in the country which does not receive either directly or indirectly certain of its supplies from that city” (Johnson 1905, p. 79). New York funds were readily acceptable means of payment everywhere because so many agents made payments there. Drafts or other credit instruments payable in New York City drawn on the local bank’s correspondent account there consequently became the most common medium for settling debts not just between interior cities and New York, but even between agents in different communities.

Toward the end of the nineteenth century, with the diffusion of deposit banking, checks drawn on individual accounts began to displace New York drafts as the instrument of payment in intercity trade. This in turn posed a problem for a centralized system of clearing and collection because banks were legally obliged to redeem checks at par only if they were presented for collection at their counter. Although clearing and collection of intercity/interregional payments had become more time consuming and complicated, the correspondent banking system provided a framework to facilitate them. Banks relied on their correspondents or correspondents of their correspondents to collect checks drawn on “foreign” banks. Settlement was still generally accomplished by the issue of a draft on a financial center, usually New York, in interregional transactions. The geographical concentration of reserves that developed with the draft system continued in spite of the change in the standard payments instrument from drafts to checks.

New York balances or exchange were traded among local banks in interior cities, thereby

allowing them to adjust the level of their correspondent accounts. Business customers sold exchange to their banks by depositing drafts or checks drawn on a New York (or other money center) bank. Banks would remit these items to their correspondent for collection and receive payment usually in the form of ledger entries to their correspondent balances, rather than shipments of cash. Thus, in the course of providing routine payment services to business customers, banks would deplete and replenish their correspondent balances. In turn, at any point in time, they could find themselves with deficient or excess correspondent balances. To remedy these imbalances, banks could arrange to ship cash to or from their correspondents, but would then incur significant transactions costs.

As an often cheaper alternative, banks developed a local wholesale or interbank market in exchange where they bought and sold surplus correspondent balances. Such a transaction – e.g., the purchase of a New York balance with vault cash – simply converted one form of excess (or clearing) reserve into another and so enabled banks to manage their overall portfolio of excess (or clearing) reserves. The price of New York funds, the domestic exchange rate, therefore was a function of the forces of local demand and supply and a direct measure of the cost of making long-distance payments. These internal exchange rates, representing the premium or discount which \$1000 in New York funds commanded in the local market, were commonly quoted in the business or financial press,. A positive number indicated New York exchange sold at a premium, and a negative figure, a discount. Thus, if the rate in Minneapolis was 50¢, \$1000 in New York sold for \$1000.50 locally, or at a .05 percent premium.

This system of internal or inland exchange rates was a fixed rate regime in normal times since the value of a dollar (in terms of gold) in New York was the same as that of one in Chicago. The spot price of New York funds in Chicago could differ from the mint parity exchange rate (one) within the currency points, the cost of shipping cash from Chicago to New York or *vice versa*, without eliciting an interregional/intercity currency flow (analogous to the gold points in the foreign exchange market under the gold standard). Weekly domestic exchange

rates reported in *Bradstreet's* magazine for six cities are shown in Figure 1 for the period between the major panics, 1894 to 1906. The graphs convincingly show that in normal times the range of fluctuations was quite circumscribed. In many or most cases an eyeball test seems sufficient to establish the bands. However in periods of panic and restrictions of cash payments the usual bounds defined by shipping costs would not apply.

II. The Panics of 1893 and 1907

The New York stock market collapsed in early May, 1893 with the failure of the National Cordage Trust. Nevertheless, most of early financial disruptions occurred in interior cities rather than in New York with panics and bank runs in several interior cities. These continued through July in such cities as Portland, Kansas City, Denver, and Louisville (Wicker 2000, pp. 65-77) In view of the resultant cash drains to the interior on June 15 the New York Clearing House authorized the issuance of Clearing House certificates as a precautionary measure. These loan certificates, granted by a special committee Clearing House to members upon application and presentation of appropriate bank asset collateral, could be used to settle adverse balances at the clearing house. They thus functioned in effect as a currency substitute in settling local interbank balances and prevented currency drains to other local clearing-house banks. But with continued external drains on reserves on August 3 New York banks restricted cash payments, strongly limiting but not completely prohibiting cash payments to liability holders. This decision was followed immediately by banks throughout the country. The restriction in New York was not however complete and banks continued to ship cash to some degree to interior banks drawing down their bankers' balances (Sprague 1910, pp. 177-178, 182). The period of restriction for New York banks lasted around one month with resumption there beginning on September 2. A chronology of the panic appears in Table 1.

In Figure 2 we present daily domestic exchange rates for the period of the panic from five major financial centers-- Boston, Chicago, St. Louis, San Francisco, and New Orleans-- as

reported to the *New York Times*. Figure 3 supplements with weekly exchange rates (every Friday) from *Bradstreet's* for six more cities— Philadelphia, Cincinnati, Louisville, Milwaukee, Kansas City, and Memphis. The cash restriction date is marked by a vertical line. Exchange rates move strongly negative in the weeks before New York suspension in Chicago, St. Louis, and Kansas City (in Milwaukee the quotes simply disappear just before and just after restriction). Since domestic exchange rates represent the price of New York funds in terms of local vault cash, when local reserves are relatively scarce New York exchange should sell at a discount (i.e., local funds at a relative premium), while when New York funds are relatively scarce they should command a premium. In contrast, in Eastern cities, such as Boston and Philadelphia, New York exchange rather than going to a discount in the weeks before restriction rises to a significant premium (falling to a substantial discount in Philadelphia afterwards, but not in Boston). In Southern cities such as New Orleans and Memphis there was little evidence of disturbance before the restriction date.³

During the panic period, exchange rates clearly become much more volatile, attaining values far outside the normal currency shipping point bounds.⁴ Rates during the period of restriction rose as high as \$8 in Boston and \$10 in New Orleans and Philadelphia. On the flip side, they fell at points as low as -\$8 in St. Louis, -\$18 in Philadelphia, -\$20 in Milwaukee, and -\$30 in Chicago.⁵ In July/August 1893 the standard deviation of the exchange rate, for example, was over 5 times larger in St. Louis, over 10 times larger in Boston, and 26 times larger in

³ Contrary also to the situation in the midwest, it was reported that in Charleston “New York exchange is scarce” (*Bradstreet's*, August 5, 1893, p. 496).

⁴ Widely cited figures from just after the turn of the century put express rates per \$1000 on currency shipments between New York and four cities as follows: Chicago, 50¢; St. Louis, 60¢; New Orleans, 75¢; San Francisco, \$1.50 (Johnson 1905, p. 82).

⁵ In St. Paul and Minneapolis New York exchange was an “unquotable commodity,” “unsalable at any price” (*Bradstreet's*, August 5, 1893, p. 496; August 12, 1893, p. 513). But interestingly, the changes in exchange rates in Kansas City and Louisville during the city-wide panics in late July were not as dramatic as in a number of other places.

Chicago.⁶

In contrast to 1893 when financial disturbances originated in the interior and eventually led to a crisis in New York, the 1907 panic followed more closely the models of 1873 and 1884 in which the initial crisis occurred among New York banks and its effects then radiated out to the interior. On October 16 when a copper corner by Augustus Heinze collapsed so also did two brokerage house which were involved and runs developed on three banks associated with Heinze. Assistance from the New York Clearing House however preserved the Heinze banks, but the financial disturbance began in earnest less than a week later with runs on New York trust companies. While a money pool organized by J. P. Morgan fended off disaster for the trust companies in the near term, interior bank withdrawals from national banks led the New York Clearing House to issue clearing-house loan certificates and suspend cash payments on October 26. From New York, virtually a nationwide restriction of payments resulted in which banks in every financial center except Washington, D.C. restricted payments. Cash payments were not resumed in New York until after the first of the year, a period of suspension more than twice as long as in 1893. Again, the chronology appears in Table 1.

Figure 4 presents daily domestic exchange rates in six financial centers (including St. Paul this time), with weekly rates for five more appearing in Figure 5. Again, the restriction date in New York is marked by a vertical line. In contrast to 1893 when the panic moved from interior points to New York, we might expect to observe “normal” conditions in regional domestic exchange markets until the unexpected shock of New York banks’ suspension in late October 1907. The patterns of exchange rates show a striking similarity across Eastern and several Midwestern (Chicago, St. Louis, St. Paul) cities here; rates increased sharply after cash

⁶ Sprague (1910, p. 297) cautions that in panic periods “the quoted rates of exchange were often without much significance” since markets might have been so disorganized that the rates were “purely nominal, representing little or no actual transactions.” Nevertheless, such extreme values might still be a useful indicator of the state of the market.

restriction by New York banks.⁷

Note that the movements in exchange rates were generally much more violent in 1893 than in 1907 (compare Figures 2 and 3 with Figures 4 and 5). One factor which might underlie this difference is that there were times in which the market completely disappears with no trades taking place (the space between the dots in the figures) and those occurrences seemed to be much more frequent in 1907 than in 1893. In Chicago in 1907, for example, there were no reported transactions in domestic exchange at all for more than a week after the cash restriction date. Perhaps a better (or at least different) measure of disruptions in the domestic exchange market then during such periods might be the number of days in which no rates are quoted. Note that in San Francisco in 1907 the market essentially disappears with no quotes for two months after suspension.

III. Differences in Severity across Cities

The impact of panic and cash restrictions clearly differed dramatically across cities and across time. Two measures of panic disruption which we could use here are the average and/or range of domestic exchange rates or the number of days over the period in which quotes did appear in periodicals but there is no quote for the city in question. What factors might influence the severity of the impact of a panic on the local domestic exchange market? Here we examine the extent to which domestic exchange dislocations or perturbations were associated with the balance sheet structure of local banks. Such data for national banks were available for five call dates per year at the reserve city level in the U.S. Comptroller of the Currency annual reports.

The extent of involvement of reserve city national banks (and central reserve cities,

⁷ Weekly rates however in Cincinnati, Milwaukee, and Kansas City however seem generally to have been little affected by the New York panic and cash restriction. San Francisco is discussed later. And as for the South, New Orleans and Memphis, Sprague (1910, p. 297) notes that exchange was at a discount or at par because due to cotton sales in the late autumn banks there were able to draw money from the Northeast.

Chicago and St. Louis) in the correspondent banking system is captured by the ratio of ‘due to banks,’ correspondent balances of country banks held in, say, Chicago, to individual deposits, predominately local claims, or by the ratio of net interbank claims (net due to banks defined as ‘due to banks’ minus ‘due from banks,’ bankers’ balances held in other reserve city or central reserve city banks) to deposits. The balance sheet data are taken from the call date immediately preceding the onset of the panic– the second, May 4, for 1893 and the fourth, August 22, for 1907. Since there are two alternative measures of disruption,⁸ it seems prudent to control for the one while using the other as a dependent variable. The estimation results from panel regressions with fixed effects on both daily and weekly data are reported in Table 2. The limited number of observations alas constrains us to just a couple of independent variables, although richer specifications would of course be quite interesting.

Even though the overall fits of the regressions are not that impressive, the results are nevertheless quite suggestive. First of all, perhaps unsurprisingly, the number of no quote days is statistically significantly inversely related to the average exchange rate during restrictions and *vice versa*. More interestingly, the higher the ratio of net due to banks to deposits, the higher the average level of domestic exchange rates (or alternatively, the more important deposits were relative to net due from banks, the lower the exchange rate or the more valuable local reserves were relative to bankers’ balances). Similarly, the number of no trade days was also positively associated with the relative level of obligations to interior or country banks. Furthermore, it was the level of due to banks, obligations to interior country banks, that was the statistically significantly more important factor in creating stringency in the local market for New York exchange. These results hold regardless of whether based on the more detailed daily data with fewer cities or on the less detailed weekly data based on more cities.

⁸ Both here are calculated over the period of cash restriction, but similar results obtain over the period from the panic onset. By the same token, due to banks ratios relative to total assets rather than deposits produced similar results.

After the panic of 1893 bankers' balance holdings became much more important relative to individual deposits for national banks in many regional financial centers (James and Weiman 2009). For example, between our 1893 and 1907 call dates the ratio of due to banks to deposits roughly doubled in Chicago and St. Louis and almost does so in Cincinnati, St. Paul, and San Francisco.⁹ In turn, these banks held higher levels of balances in New York, but generally somewhat less than proportionally since the ratio of net due to banks to deposits increased somewhat in most cities. The premia on New York exchange which we generally observe in 1907 reflect, among other things, the increased role of the correspondent banking system and the position of New York in that system. Some of our cities— Chicago, Kansas City, Louisville, Milwaukee— experienced local banking panics in 1893 which must have contributed to the large discounts on New York exchange observed there, but such local distress can not account for the large discounts in other cities such as Cincinnati or St. Louis, where also the value of vault cash relative to New York funds rose dramatically.

A quantity measure, cash flows, collected by Kemmerer (1910) for his National Monetary Commission study, represents an alternative index of the disruptions to intercity correspondent relationships during panics to the price measure, domestic exchange rates. Based on circulars sent to clearing houses in major money centers, he reported the monthly cash flows into and out of each city by their geographical origin and destination respectively. The series covers the period 1905 to 1908 for most cities (and thus includes the months of November and December 1907 in particular).¹⁰ There are then two possible measures of intercity cash flows.

⁹ Chicago- .64 to 1.28; St. Louis- .65 to 1.28; Cincinnati- .39 to .66; St. Paul- .33 to .51; San Francisco- .36 to .66. In Philadelphia the increase was even larger, .23 to .82.

¹⁰ Surveys were received from 32 city clearing houses (26 were usable) reporting monthly cash inflows and outflows. The sources and destinations of these flows were typically listed as states rather than specific cities. But it seems reasonable to take flows from Chicago to New York to have been directed to New York City and flows reported from New York City to Illinois to have been primarily directed to Chicago. There are therefore two possible measures of intercity flows which do not necessarily coincide. First of all, New York City clearing house

The first (nycflow) is cash shipments reported by New York banks to and from interior points, say Chicago, plus transfers of cash by New York banks to the interior accomplished through the U.S. Subtreasury in New York City;¹¹ the second (cityflow) is cash flows to and from New York as reported by interior, say Chicago, banks.

Table 3 presents inflows, outflows, and net flows of cash from New York to nine interior cities, as reported by the New York Clearing House (nycflow), for the panic months of October, November, and December 1907. New York is the reference point, so a negative net flow figure indicates a net drain of cash from New York to the interior city. The first three columns show value in \$1,000; the second three show the ratio of the 1907 figure to the 1905/06 average for the respective months; the last three columns relate the size of the flows to reserves on hand (specie plus legal tender notes) at the call date immediately preceding the panic. First of all, it is clear that the restriction of cash payments in New York on October 26 did not stop the cash outflows from the city. The currency drain from New York to interior reserve city banks continued, often at increased volume, during the restriction period of November and December. These outflows were generally much larger than usual (as compared with the average monthly flows for 1905

banks reported cash inflows and outflows to all Illinois (Chicago) banks whether they belonged to the local clearing house or not. Second, the Chicago clearing house reported cash inflows and outflows to all New York banks regardless of their clearing house status (thus including trust companies). Indeed, Chicago also illustrates a problem with some interior city (in contrast to New York) reports—the Chicago clearing house had 20 members (Cannon 1910, p. 276) but only eight to ten of them reported cash flows to the NMC (Kemmerer 1910, p. 53). Generally however the two series are reasonably close, so the choice of reporting city is not crucial to the pattern of results. Finally, these data are reflective of intercity cash flows but not of total inflows and outflows since typically intrastate flows are not covered. For example, cash flows between New York City and the rest of New York state or between Chicago and the rest of Illinois are not reported.

¹¹ The U.S. Treasury was willing to transfer cash for New York banks to interior Subtreasuries via telegraph at rates equal to express charges (Kemmerer 1910, pp. 129-131, 361).

and 1906), as evidenced in the middle three columns of Table 4.¹² Moreover, they were generally large relative to cash on hand prior to the panic. Most cities here experienced at least one month in which inflows were equal to a quarter to a third of prior call date reserves on hand (and even more in San Francisco).

The cross-section regressions reported in Table 4 relate the magnitude of net cash flows between New York and interior cities to the balance sheet structure of reserve city national banks at the call date (August 22) immediately preceding the panic—levels of due to banks, due from banks, and individual deposits. Since the sale of New York balances in the local domestic exchange market, converting New York funds into local vault cash, represented an alternative to drawing down balances there directly, we also include an index of the activity of the domestic exchange market, the number of weekly observations in which no quotes were listed, as an additional independent variable. In panel I the dependent variable is the total net flow of cash between New York and the interior city; in panel II it is the difference between the 1907 flow and the 1905/06 average. The first two columns use flows as reported by the New York Clearing House (an outflow from New York to an interior city is negative); the next two use flows as reported by the interior city clearing house (a flow from New York to the interior city is positive). Columns 1 and 3 cover the months of October, November, and December; columns 2 and 4 cover only the restriction months of November and December.

¹² Curiously, these strong cash outflows from New York occurred in months when New York exchange generally sold at a significant premium in interior cities. Perhaps this could be reconciled if most of the outflow occurred in the days immediately following restriction when the domestic exchange market disappeared in many cities. For example, the subsequent high exchange rates in Philadelphia and St. Louis were attributed to banks having “drawn down their balances at New York so low that they cannot supply New York exchange for mercantile and other remittances to this city” (*Wall Street Journal*, November 15, 1907, p. 8). In the days around the announcement of restriction in New York in Chicago. Because of the uncertainties of the payments restrictions, “Chicago banks refused to increase their credits in New York for the reason that they did not want evidences of money instead of money itself.” While domestic exchange was offered, there were no bids, “a most significant circumstance” (*Chicago Tribune*, October 25, 26, 1907). However, less than two weeks later \$1.50 a thousand was bid, but none was offered (*Chicago Tribune*, November 5, 1907).

Again, regardless of the specific specification, the general tenor of results is quite consistent. The less active the local domestic exchange markets, as measured by the number of no trades reported weeks, the larger the intercity flows (outflows from New York in columns 1 and 2; inflows into interior cities in columns 3 and 4). The larger the level of due from banks, the smaller the level of net outflows to the interior rather surprisingly (except for column 1 in panel II, where the estimated coefficient is not significantly different from zero). More importantly, the size of due to banks liabilities, country banks accounts in reserve city banks, was a strong and statistically significant influence on the volume of New York outflows during the last part of 1907. This results holds in every specification. Moreover, the magnitude of the estimated coefficients of duetobanks are also consistently much larger than those of local deposits, which are also generally not statistically significantly different from zero except in columns 3 and 4 of Panel II. Due to bank liabilities rather than local deposit liabilities appear to have been the primary factor underlying the volume of cash outflows to reserve city banks during the panic.

Both the price evidence on domestic exchange rates and the quantity evidence on the size of cash flows from New York to regional financial centers point in the same direction. The local disruptions of the exchange market, as measured by exchange rate movements, no trade days, or the volume of net cash flows, in interior financial centers were strongly related to the level of due to bank liabilities at reserve city national banks. Withdrawals by hinterland country banks rather than by local depositors must have been the principal factor leading to the pressure on the intercity payments network (Noyes 1894; Sprague 1910). This is unfortunately primarily a inference (albeit a strong one) however because it is not possible to measure cash drains to the hinterland from reserve cities directly-- the NMC cash flow data do not include intrastate movements.¹³

¹³ However the Chicago Clearing House did report currency shipments to country banks of \$37,694,250 in contrast to currency received from the east of \$10,505,740 in October, 1907

IV. Payments Disruptions

By limiting access to their money center accounts, withdrawal restrictions can seriously if not fatally compromise the liquidity of local banks, and in turn deprive their customers of the means to effect vital transactions such as meeting payrolls. Moreover, if agents are liquidity-constrained and so prefer to (or out of necessity must) finance their current payments on the basis of their current cash flows, these disruptions can set off a downward spiraling chain reaction through the payments system. The magnitude of such payments disruptions will depend on many factors, but most obviously and directly the greater frequency of local cash payments and local banks' excess (clearing) reserves held as vault cash. These two factors are clearly related. If the non-bank public conducts a larger share of its transactions in cash – or equivalently if banks function more as “coat checks” storing customers' cash until needed – banks will tend to hold larger shares of their excess reserves as vault cash. Excess cash reserves will provide banks with an initial buffer that may tide them over a short, mild suspension shock. If it persists, however, customers' normal and “panicky” cash demands will deplete banks' excess reserves. Responding in kind, local banks will also restrict payments, which will have more severe effects because of customers' greater reliance on cash payments.

In the alternative scenario banks economize on their excess cash reserves, because their customers conduct a larger share of payments in drafts and checks – so called “credit instruments.” Unlike cash payments, they can be settled through the transfer of correspondent deposits through the (local or distant) clearinghouse without any withdrawal of funds. In turn, they hold larger excess correspondent balances because of uncertain clearing demands, especially from customers' less predictable check payments. In this case the impact of a cash restriction is potentially greater, especially if customers run on the banks and increase their cash

(\$30,200,500 and \$9,620,000 respectively in October 1906) (*Chicago Tribune*, November 7, 1907).

relative to deposit transactions. On the other hand, the impact of a restriction will be weaker, if customers continue to rely on some form of bank money, which can be settled through the transfer of their “frozen” correspondent balances.¹⁴

As we have shown elsewhere (James, McAndrews, and Weiman 2008; James and Weiman 2009), the Panic of 1893 and resulting Great Depression was a significant watershed in the formation of the modern U.S. payments system, characterized by the greater use of check transactions relative not only to bank drafts but also to cash. With the diffusion of deposit banks and check transactions, more cities formed local clearing-houses to mediate local payments and interbank settlement depended more on banks’ correspondent balances, not vault cash. Consequently, payments restrictions in 1907 would have had more devastating impacts, at least in theory, if panicky bank customers lost confidence in banks and increased their relative demands for cash and cash payments instruments. Given the differences in velocity between cash and checks (Fisher 1911), real effects could have been even greater in magnitude than would have been predicted by simple money multiplier effect.

We qualify this last prediction, because it abstracts from the complementary institutional innovation of the clearing-house organization which enabled banks to mount a collective, not individual, response to the withdrawal restrictions. Clearing-houses had assumed a critical lender of last resort function, supplying member banks with loan certificates as substitutes to cash reserves for their clearing-house settlements (Timberlake 1984; Roberds 1995). During the 1907 panic, they greatly broadened the scope of their quasi-central-bank authority by issuing low-denomination loan certificates which circulated as cash substitutes. Of dubious legal authority, this innovation could effectively tide local banks over the potential restrictions storm,

¹⁴ Again, the willingness of banks and the public to hold these ‘coat checks’ rather than convert them into cash is crucial. Otherwise, situations might become as in Louisville in 1893, where business was “almost at a standstill, banks declining to receive country checks even for collection and preferring not to handle New York exchange” (*Bradstreet’s*, August 12, 1893, p. 511).

if it restored customers' confidence in the banking system, not individual banks.

Andrew (1908, p. 502) chronicles the nature of local cash payment restrictions during the Panic of 1907. Inquires sent to banks in all cities with populations greater than 25,000 revealed that in two thirds of them banks restricted cash payments to some degree, with Washington, D.C being the only financial center not to restrict. In some cities bank customers were limited to a total cash withdrawal (of, say, \$25 or \$100); in others, daily withdrawals were restricted to \$25, or \$50, or \$100 per day; in many or most cities including New York the restrictions were "discretionary."¹⁵ Such limitations on the ability of bank customers to convert their deposits into cash most probably had serious and immediate effects¹⁶. The Comptroller of the Currency (1907, p. 70) noted that "all domestic exchanges were at once thrown into disorder and the means of remittance and collection were almost entirely suspended... This [derangement of the machinery for making collections and remittances] has interfered with every kind and class of business and led to great curtailment of business operations of every kind."

To the extent that checks were not readily acceptable everywhere and that recipients were not content simply to deposit them into their accounts, bank liabilities did not fully fulfill their role as a medium of exchange. Rockoff (1993) argues that this fact alone represented a decrease in the quality-adjusted money supply and could have disrupted planned spending. Moreover, business firms, unable to procure cash to meet payrolls, were forced to layoff workers and shut down plants. Sprague (1910, pp. 202-203) notes that while in July, 1893 newspapers published

¹⁵ Refusals by New York banks to pay out cash for their interior correspondents in 1907 are described in Senate Document No. 435 (U.S. Senate 1908). In 1893 restrictions were discretionary as well. "The majority of New York institutions continued to pay cash on demand to all depositors, and those which did refuse cash payments not only offered to such depositors checks on other banks, but cashed small checks without inquiry," but "the banks which did shut down on cash payments to depositors included several of the soundest institutions in the city" (Noyes 1894, pp. 26-27).

¹⁶ Kroszner (2000, p. 162), however *au contraire* argues "the temporary suspension of cash payments in late 1907, while causing some inconveniences, allowed the banks to continue to provide payments functions..."

many accounts of factories closing due to failures, inability to make collections or to obtain credits from banks, by August, after restriction, the most frequently cited cause had become the inability to procure cash to make payrolls. Toward the end of the month however some factories began to reopen and cash payments were restored in September.

Difficulties in meeting cash payrolls appeared to have been less pronounced in 1907 than in 1893 (Sprague 1910, p. 290)¹⁷ even though Andrew judged the 1907 panic as the more disruptive to local payments. “Probably the most extensive and prolonged breakdown of the country’s credit mechanism which has occurred since the establishment of the national banking system... Even during the critical periods of 1873 and 1893 it is unlikely that as many banks limited the payment of their obligations in cash” (1908b, p. 497). The 1907 panic was characterized by the extensive issue of local emergency currency or currency substitutes.¹⁸ Banks in many localities issued small denomination clearing house certificates, obligations of the clearing house which could circulate from hand to hand (as opposed to the traditional large denomination ones used in interbank settlement); clearing house checks, again typically in small denominations and payable through the clearing house (i.e., not convertible into cash), but drawn on particular banks; cashier’s checks in convenient denominations which were “practically circulating notes”; New York drafts in denominations of \$1 up (in Birmingham); negotiable certificates of deposit to be used in local payments; or, finally, pay checks drawn by bank customers upon their banks in small denominations and used for payments of wages (widely used in Pittsburgh) (1908b, pp. 506-512).

Clearing house loan certificates in large denominations for interbank settlement however constituted the great bulk (over 70 per cent of the total) of the measurable issues of emergency

¹⁷ Although the *Chicago Tribune* (November 23, 1907) notes that “some plants are idle because of the difficulty experienced in obtaining cash with which to pay employees...”

¹⁸ These instruments were employed in 1893 as well, although not to the extent as in 1907. See Warner (1896).

currency in the 145 largest independent cities polled by Andrew. This was true in both reserve and non-reserve cities. The results of a regression with the total volume of cash substitutes issued by city in 1907 on balance sheet structure of national banks (as of September 1906) and dummy variables for reserve city status are reported below (t statistics in parentheses).

$$\begin{aligned} \text{Totalissue}_i = & .1254 \text{Duetobanks}_i - .1283 \text{Duefrombanks}_i + .0458 \text{Individualdeposits}_i \\ & (3.17) \qquad \qquad \qquad (-3.65) \qquad \qquad \qquad (1.91) \\ & + 7591.479 \text{Centralreservecity}_i + 528.285 \text{Reservecity}_i - 1.760 \text{Population}_i - 132.673 \\ & (2.99) \qquad \qquad \qquad (0.58) \qquad \qquad \qquad (0.59) \qquad \qquad \qquad (-0.16) \end{aligned}$$

Adjusted R² = .9877; NOBS= 33

Note first of all the symmetry in the effect on the volume of cash substitutes issued between duetobanks and duefrombanks-- one dollar more in obligations to other banks increasing the amount of cash substitutes created, while a one dollar increase in interbank balance holdings decreasing it by a similar amount. More importantly here however, the level of interbank balances held by national banks in the city had a much stronger influence on the volume of issue than did the level of individual deposits (both have significantly positive estimated coefficients however). This result holds even allowing for differences in reserve city status across cities. In particular, central reserve cities seem to have faced much stronger withdrawal demands from their correspondents (given the level of duetobanks), resulting in the issue of more cash substitutes. Such a result supports the observations of contemporaries (Sprague 1910; Andrew 1908a) who primarily blamed country correspondent banks for the large withdrawals creating pressure on reserves and leading to cash restrictions and the issue of substitutes rather than local individual depositors.¹⁹ Finally, population is included in the

¹⁹ The Comptroller of the Currency (1907, p. 70) for example observed “that there has actually been more of a panic among the banks themselves than there has been among the people. The banks have been fearful as to what might develop, and finding their usual reserve

regression as a scaling factor.

Andrew estimated the volume of cash substitutes outstanding during the 1907 restrictions at over \$500 million, as compared with a currency stock of \$1,810 million in 1907 IV (Friedman and Schwartz 1970, p. 65). “For two months or more these devices furnished the principal means of payment for the greater part of the country, passing almost as freely as greenbacks or bank-notes from hand to hand” (1908b, p. 515).²⁰ To be sure, these instruments must have been imperfect substitutes for true currency, and this deterioration of the quality of the money stock may have had some adverse effects, but at the same time they must have relieved some of the pressure on local banks’ vault cash. After all as we have seen, during the 1907 restriction New York exchange was typically at a substantial premium (until late in the period in any case), indicating that however scarce local reserves may have been, New York exchange was even scarcer. Andrew (1908b, p. 516) concluded that the substitutes “worked effectively and doubtless prevented multitudes of bankruptcies which otherwise would have occurred.”

The issue of currency substitutes must have mitigated the problems in making local payments to some degree, even though converting New York balances into vault cash during restrictions remained quite costly. There was no such substitute available however to offset the dislocations of the non-local, interregional payments system.²¹ The timeliness and predictability

deposits only partially available, if available at all, they have been compelled in self-protection to gather from every source all the money they could possible reach... With the exception of the first excitement in New York and smaller runs in other places, there has really been surprisingly little excitement or uneasiness among the people.”

²⁰ The largest component of this total however remained the traditional large-value clearing house loan certificates (\$238 million as compared with an issue of \$69.1 million in 1893) (see Table 1).

²¹ A resolution of the Merchants’ Association of New York passed November 21, 1907 read in part: “Checks payable ‘through clearing-house only’ are useful for local settlements, but do not pay non-local debts. The business of all large manufacturing and mercantile concerns is chiefly non-local, and cannot go on if local funds are everywhere tied up. Interstate exchange is essential to the conduct of interstate business, and this constitutes the greater part of our domestic exchanges. Provision for the settlement of local indebtedness is helpful, but provision

of intercity payments was disrupted, with the only alternative being shipping currency (if available), a process which clearly delayed final settlement of transactions. Such interferences with making payments at a distance and hence with the smooth functioning of the payments system should have had an adverse effect on internal trade. *Bradstreet's* in 1893 noted “the clog to trade shown by prohibitive rates for New York exchange at centers east, west, and northwest” (August 5, 1893, p. 495). Similarly, the *Wall Street Journal* observed in 1907 the “disorganization of domestic exchanges which prevents the free movement of commodities for export” (December 2, 1907, p. 8).²²

It is, of course, impossible here to isolate precisely the impact of payments disruptions alone from the concurrent effects of credit contraction during panics and cash restrictions.²³ In 1893 panic and also payments disruptions preceded general cash restrictions in several interior cities; in 1907 panic and cash restrictions were only days apart (October 21 and 26). That said, the economy did seem to go into a tailspin during periods of restrictions of cash payments. Monthly figures for four quantity measures of trade and economic activity— freight ton-miles, pig iron production, the Babson (physical quantity) index of business activity, followed by the Miron-Romer monthly index of industrial production (U.S. Bureau of the Census 1949, pp. 332-334; Moore 1961, p 130; Miron and Romer 1990)— for 1893 and 1907 are presented in Figure 6.

for the settlement of non-local indebtedness is essential, and, therefore, still more helpful” (*Bankers' Magazine*, December, 1907, p. 970).

²² The grain trade seemed to have been particularly affected. “Naturally, there has been some dislocation of the nation’s business, notably in domestic exchanges, which has reacted on the collecting and forwarding forces by a time stopping the buying of wheat in the Northwest and of cotton at the South” (*Bradstreet's*, November 2, 1907, p. 698). By mid-month, “One especially hopeful sign has been renewal of grain purchases in the Northwest, exchange checks on larger interior markets being the medium of exchange, thus allowing of the resumption of grain forwarding...” (November 16, 1907, p. 730). In the flour trade, “shipments [were] falling off by reason of difficulty in financing drafts, and the wheat price is now secondary to the question of finance” (*Bradstreet's*, November 23, 1907, p. 747).

²³ For example, between the May 4 and October 4 call dates in 1893 loans of national banks fell by almost 15 percent (Sprague 1910, p. 208).

The NBER-dated business cycle peaks were in January, 1893 and May, 1907 (Burns and Mitchell 1946, p. 78). Clearly the graphs show little indication of a serious downturn in either case until the onset of the financial panics in May, or particularly in June, 1893 and October, 1907, after which time the indicators fall sharply. The months bracketing the restriction periods—July and September in 1893, October and January (1908) for 1907— are marked by vertical lines. The pronounced declines in the series during the cash restrictions period in 1907 are evident. In 1893 the sharp decline begins in June but accelerates after July, with cash restrictions, although this is less evident to the untrained eyeball.^{24, 25} Moreover, rather dramatically in virtually every case the decline stops and/or the series turn up with the resumption of cash payments in September, 1893 and January, 1908.²⁶

The declines over the periods of cash restrictions in 1893 and 1907 in most cases were quite comparable. The Miron-Romer industrial production index, for example, declined by 16.7 percent between July and September in 1893 and by 21.7 percent between October 1907 and January 1908.²⁷ The period of cash restriction was twice as long in 1907 as in 1893, so if one thinks of the effects of restriction as being a continuing process— the difficulty of obtaining cash

²⁴ Log-linear regressions on time from June to September, 1893 show statistically significant sharper rates of decline after July.

²⁵ Railroad earnings could be another measure of the volume of trade. While they ran higher in 1893 than in same month in 1892 for the first half of the year and then declined by almost 5 percent relative to 1892, in August, the month of suspension, the figure was more than 13 percent lower than for the comparable month in 1892 (and 10 percent lower in September after resumption) (*Commercial and Financial Chronicle*, February 25, 1894).

²⁶ Sprague (1910, pp. 201-02) notes for 1893, “Much of the decline in August, with the subsequent partial recovery, can only be ascribed to the trade paralysis produced by the financial situation at that time.” Of course, the economy only stabilized rather than bounced back after resumption, but “after the beginning of September the course of the crisis of 1893 was no longer a banking affair” (p. 209).

²⁷ Freight ton-miles fell by 10.8 percent between July and September, 1893 and by 10.4 percent between October, 1907 and January, 1908. The declines in pig iron production were 42.2 and 52.8 percent, respectively, while in the Babson index they were 12 and 18 percent.

to meet local payrolls or of making payments at a distance— then the per month real effects of restriction in 1907 were less severe than in 1893, even though the cash restrictions in 1907 have been characterized as both more widespread and more severe than in 1893 (1908b, p. 497).

There are a couple of reasons why this may have been so. First, of course, the issue and use of local cash substitutes was much more extensive in 1907. Second, by around the turn of the century checks had become standard payments in interregional transactions (Kinley 1910). To the extent that recipients were willing simply to deposit checks received in their accounts, rather than attempting to cash them, and in turn use the proceeds to issue checks of their own, there would not have been a total collapse of the payments system, although collections may have been rather slower.

V. Conclusion

The private payments networks based on the correspondent banking system which had developed to clear and settle interregional or intercity transactions in the pre-Federal Reserve period were normally quite efficient arrangements. However when the convertibility of New York balances was threatened or limited, these networks were also important channels for transmitting financial pressures. Such restrictions in turn had serious consequences for payments settlement at both the local and interregional level and consequently for the level of economic activity. The degree of disruption to domestic exchange markets in regional financial centers over this period was increasingly a function of their place in these intercity networks rather than local conditions. Banks in reserve cities with larger holdings of bankers' balances from country banks relative to individual deposits experienced greater strains in 1907. On the other hand, the increasing acceptance of checks relative to cash mitigated some of the real shock.

Most contemporary writers (e.g., Noyes 1894; Sprague 1910) thought restrictions of cash payments were disasters, and monthly evidence from 1893 and 1907 suggest that the downturns intensified during these periods. In the more recent literature, the effects of these restrictions

have been usually minimized or neglected. Even though widespread bank failures were avoided, the medicine may nevertheless have had serious debilitating effects. Richard Grossman (1993) demonstrates that cyclical downturns were more severe in the national banking period when associated with a financial crisis than when they were not. His simulations show that a relatively small bank failure shock could have led to a 2 percent decline in real GNP, while a large shock would have been catastrophic. Based on the timing of the bank failures and the immediacy of the effects on output, it seems reasonable however to suppose that some of the short-run adverse effects, perhaps most, of what Grossman attributes to bank failures may well have been the impact of payments system disruptions.

Prevention of such widespread and severe disruptions of the payments system in the wake of financial crises was the fundamental financial reform issue to many or most contemporaries and led directly to the establishment of the Federal Reserve system. A principal feature of the new central bank was the nationalization of the interbank settlement network. Fed institutions such as the gold settlement fund and Fedwire (for telegraphic transfers of reserves) replaced their private analogues, New York balances held to settlement payments and the domestic exchange markets.

The Fed's takeover of the interbank settlement system was not peculiar to the U.S. payments system. According to the most recent survey of payments systems by the Bank for International Settlements (2005), central banks own and operate the main large-value (interbank) payments network in virtually all developed economies, either outright or in a partnership arrangement. What distinguishes the U.S. payments system from that of other countries and remains controversial to this day was the Fed's entry into the check clearing system and the relative efficiency of public and private clearing systems (Stevens 1996; Lacker, Walker, and Weinberg 1999; Gilbert 2001). However even today in the face of the increased privatization of the payments system spurred in large part by the Monetary Control Act of 1980, the Federal Reserve still plays an potentially crucial role as the clearing house of last resort in financial

crises (Summers and Gilbert 1996; James and Weiman 2005).

Table 1
Panics of 1893 and 1907

	<u>1893</u>	1907
Panic onset	May 1	Oct 21
Issue of Clearing House loan certificates in NYC	June 21	Oct 26
Aggregate loan certificate issue, NYCH (\$ million)	16.6	41.5
Maximum amount outstanding (\$ million)	15.2	38.3
Bank reserves of NYCH members (\$ million)*	95.6	121.0
Ratio of maximum certificates issued to reserves	15.9 %	31.7 %
Loan certificate issue nationwide (\$ million)	69.1	238.1
Restriction of cash payments in NYC	Aug 3	Oct 26
Resumption of cash payments in NYC	Sept 2	Jan 1

* on May 6, 1893; Oct 19, 1907.

Sources: Andrew (1908), p. 507; Sprague (1910) , pp. 34, 145, 163, 261-62, 432-33 ; Roberds (1995), p. ; Wicker (2000), pp. 9, 121.

Table 2
Balance Sheet Panel Regressions
(t statistics in parentheses)

I. Daily data¹

<u>Independent variable</u>	<u>Dependent variables</u>					<u>R²</u>	<u>Prob>F</u>
	<u>xrateaverage</u>	<u>notradedays</u>	<u>netduetobanks/deposits</u>	<u>duetobanks/deposits</u>	<u>constant</u>		
notradedays	-3.8015 (2.92)		113.186 (3.30)		-26.500 (-2.12)	.0143	.0987
notradedays	-2.5265 (-3.33)			60.3037 (4.52)	-25.056 (-2.83)	.0592	.0452
xrateaverage		-0.1947 (-2.92)	27.6489 (5.62)		-7.1764 (-4.28)	.0007	.0251
xrateaverage		-0.3114 (-3.33)		21.2247 (4.61)	-9.4111 (-3.87)	.0011	.0429

II. Weekly data²

<u>Independent variable</u>	<u>Dependent variables</u>					
	<u>xrateaverage</u>	<u>notradeweeks</u>	<u>netduetobanks/deposits</u>	<u>duetobanks/deposits</u>	<u>constant</u>	<u>R²</u>
<u>Prob>F</u>						
notradeweeks	-0.1276 (-1.64)		4.7174 (1.61)		-1.3318 (-1.19)	.0001 .2616
notradeweeks	-0.1765 (-2.82)			4.3287 (3.04)	-2.7321 (-2.59)	.0017 .0410
xrateaverage		-2.1784 (-1.64)	27.0337 (2.74)		-9.9676 (-2.93)	.0770 .0610
xrateaverage		-3.0133 (-2.82)		20.0548 (4.20)	-13.847 (-4.42)	.1347 .0096

¹ Boston, Chicago, St; Louis, New Orleans, San Francisco

² Boston, Philadelphia, Cincinnati, Chicago, Milwaukee, St. Paul, St. Louis, Kansas City, New Orleans, San Francisco

Table 3

Cash Flows between New York and Interior City Banks as Reported by the New York Clearing House, 1907

<u>City</u>	\$1,000			Relative to 1905/06			Relative to reserves on hand		
	<u>netflow</u>	<u>outflow</u>	<u>inflow</u>	<u>netflow</u>	<u>outflow</u>	<u>inflow</u>	<u>netflow</u>	<u>outflow</u>	<u>inflow</u>
I. Central Reserve Cities									
Chicago									
October	-8631	8633	2	1.45	11.503	4.00	-0.13	0.13	0.00
November	-17231	17241	10	4.98	68.96	.	-0.26	0.26	0.00
December	-9507.9	9539.9	32	2.03	9.79	0.14	-0.14	0.14	0.00
St. Louis									
October	-2701	2701	0	1.04	9.39	.	-0.10	0.10	0
November	-7587.2	7588.2	1	2.72	18.97	.	-0.28	0.28	0.00
December	-4941.5	5002.5	61	5.16	200.1	2.44	-0.18	0.19	0.01
II. Reserve Cities									
Boston									
October	-8105	8452	347	4.79	19.41	0.80	-0.36	0.38	0.02
November	-1667	1900	233	-7.23	1.18	0.14	-0.07	0.09	0.01
December	342	674	1016	0.51	0.23	0.35	0.02	0.03	0.05

Philadelphia									
October	-7921	8810	889	10.05	8.77	0.89	-0.30	0.34	0.03
November	-6477	7171	694	3.77	8.09	0.78	-0.25	0.27	0.03
December	-746	2977	2231	-0.60	0.96	0.72	-0.03	0.11	0.09
Cincinnati									
October	-293	660	367	0.52	2.09	3.15	-0.04	0.10	0.05
November	-2494.5	2695.5	201	-9.07	6.06	0.45	-0.37	0.40	0.03
December	-942.9	1248.9	306	-6.44	3.27	.80	-0.14	0.19	0.05
Milwaukee									
October	-723	723	0	10.71	10.71	.	-0.14	0.14	0
November	-595	603	8	34.0	34.46	.	-0.12	0.12	0.01
December	-162	362	200	3.24	3.24	.	-0.03	0.07	0.04
Minneapolis/St. Paul									
October	-1040	1045	5	8.56	2090.0	10.0	-0.29	0.29	0.00
November	-895	895	0	-4.25	3.31	0	-0.25	0.25	0
December	55	256	311	0.06	0.28	0.34	0.02	0.07	0.09
New Orleans									
October	-892	910	18	0.34	0.51	7.20	-0.34	0.34	0.01
November	-2117	2196	79	0.77	1.32	52.67	-0.80	0.83	0.03
December	-3143.5	3193.5	50	0.86	1.37	16.67	-1.19	1.21	0.02

San Francisco

October	-2723	3694	971	-4.47	5.81	1.55	-0.27	0.37	0.10
November	-13163.6	13169.6	6	5.12	3.29	0.01	-1.32	1.32	0.00
December	-2858.5	3441.5	583	0.71	0.83	1.78	-0.29	0.35	0.06

Source: Kemmerer (1910), pp. 276-357.

Table 4
Cash Flow Regressions
(t statistics in parentheses)

I. Total intercity net cash flows

<u>Independent variable</u>	Dependent variable			
	nycflow		cityflow	
	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>
notradeweeks	-3452.56 (-6.79)	-3423.20 (-7.83)	4685.74 (16.53)	3762.08 (18.38)
duetobanks	-0.1943 (-6.79)	-0.2153 (-6.76)	0.2815 (13.81)	0.2176 (14.78)
duefrombanks	0.2305 (4.46)	0.3574 (6.22)	-0.4156 (-11.06)	-0.3913 (-14.42)
deposits	-0.0147 (-1.43)	0.0025 (0.21)	-0.0090 (-1.22)	0.0061 (1.15)
constant	-2233.76 (-2.12)	-3246.57 (-2.79)	1419.36 (1.65)	852.47 (1.37)
R ²	.9749	.9527	.9895	.9922
NOBS	9	8	9	8

II. Difference between 1907 and 1905/06 net cash flows

<u>Independent variable</u>	Dependent variable			
	nycflow		cityflow	
	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>
notradeweeks	-2287.449 (-4.58)	-2041.272 (-5.00)	3414.618 (10.51)	2446.614 (13.60)
duetobanks	-0.0845 (-2.33)	-0.1412 (-4.76)	0.2416 (10.33)	0.2142 (16.55)
duefrombanks	-0.0200 (-0.31)	0.1796 (3.35)	-0.2872 (-6.67)	-0.3393 (-14.23)
deposits	-0.0080 (-0.61)	0.0031 (0.29)	-0.0338 (-4.00)	-0.0106 (-2.27)
constant	484.479 (0.36)	-1304.725 (-1.19)	1437.90 (1.46)	1021.318 (1.87)
R ²	.9150	.9139	.9707	.9899
NOBS	9	8	9	8

Figure 1: Weekly Domestic Exchange Rates for Selected Cities, 1894-1906

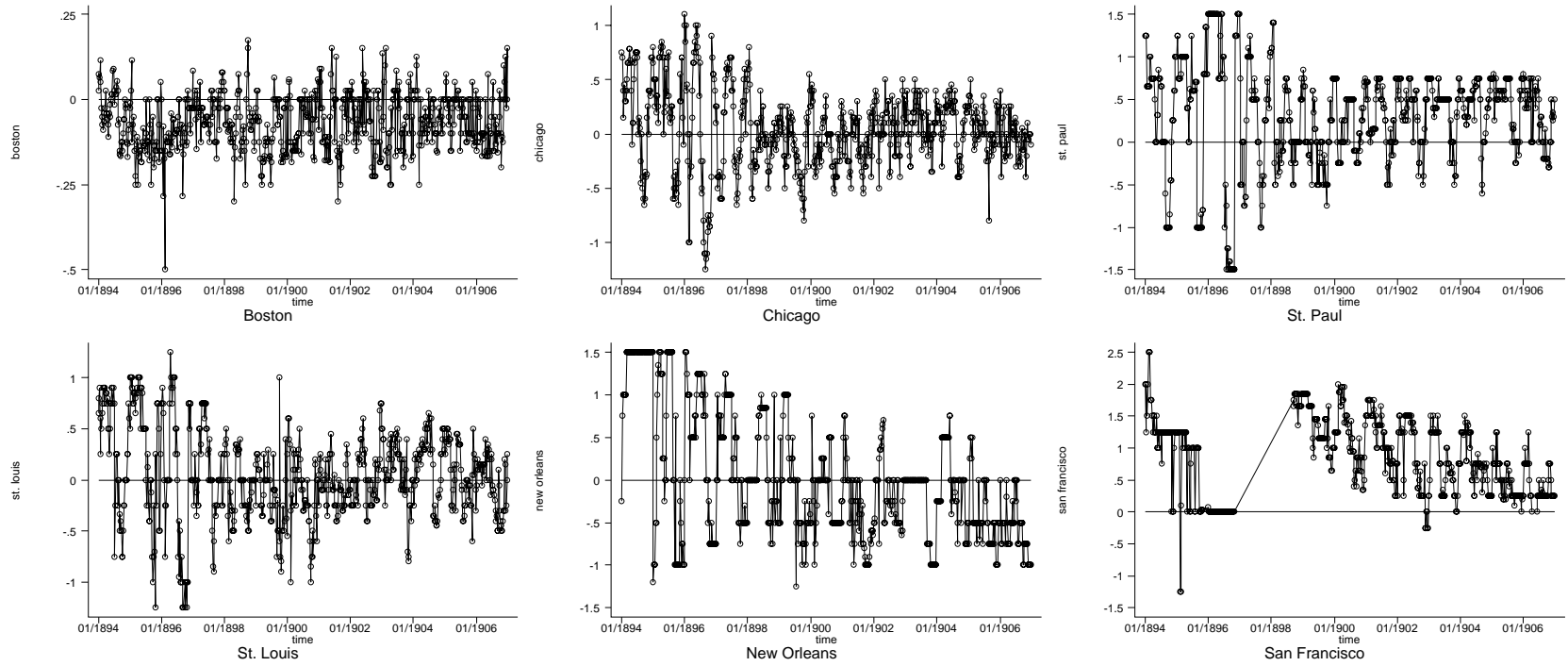


Figure 2: Daily Domestic Exchange Rates in the Panic of 1893

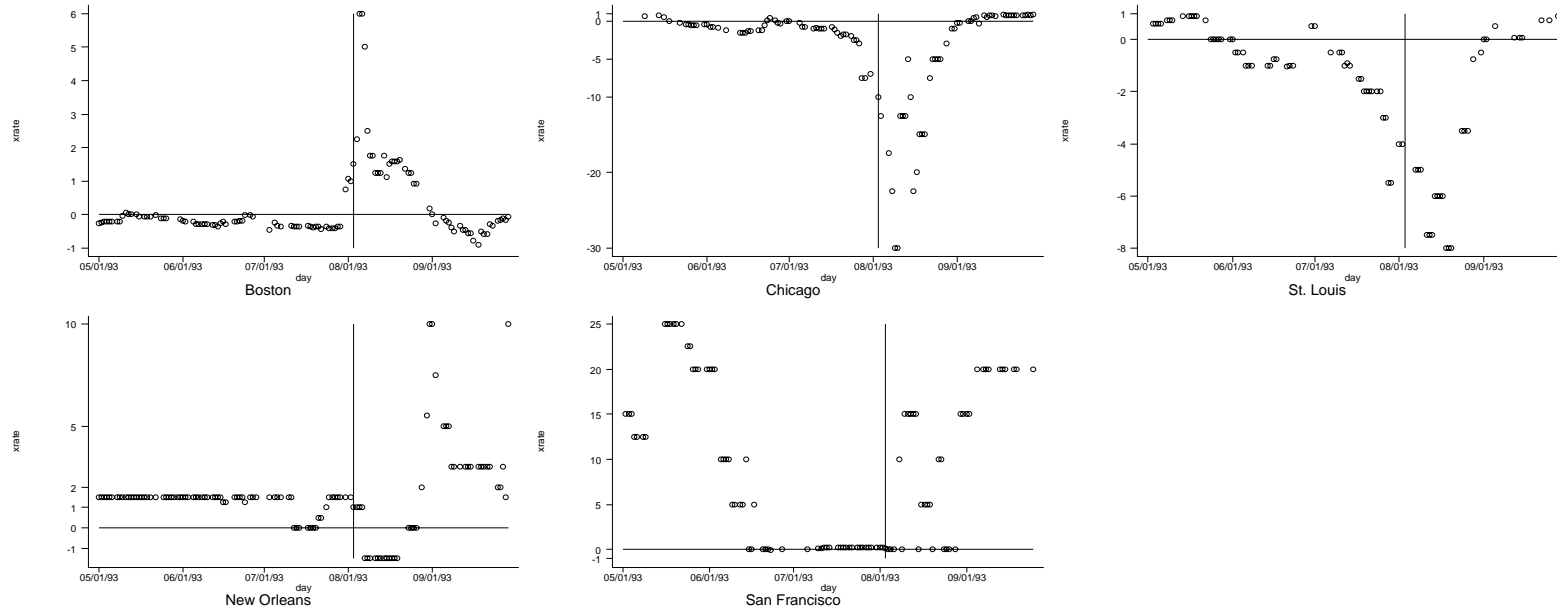


Figure 3: Weekly Domestic Exchange Rates in the Panic of 1893

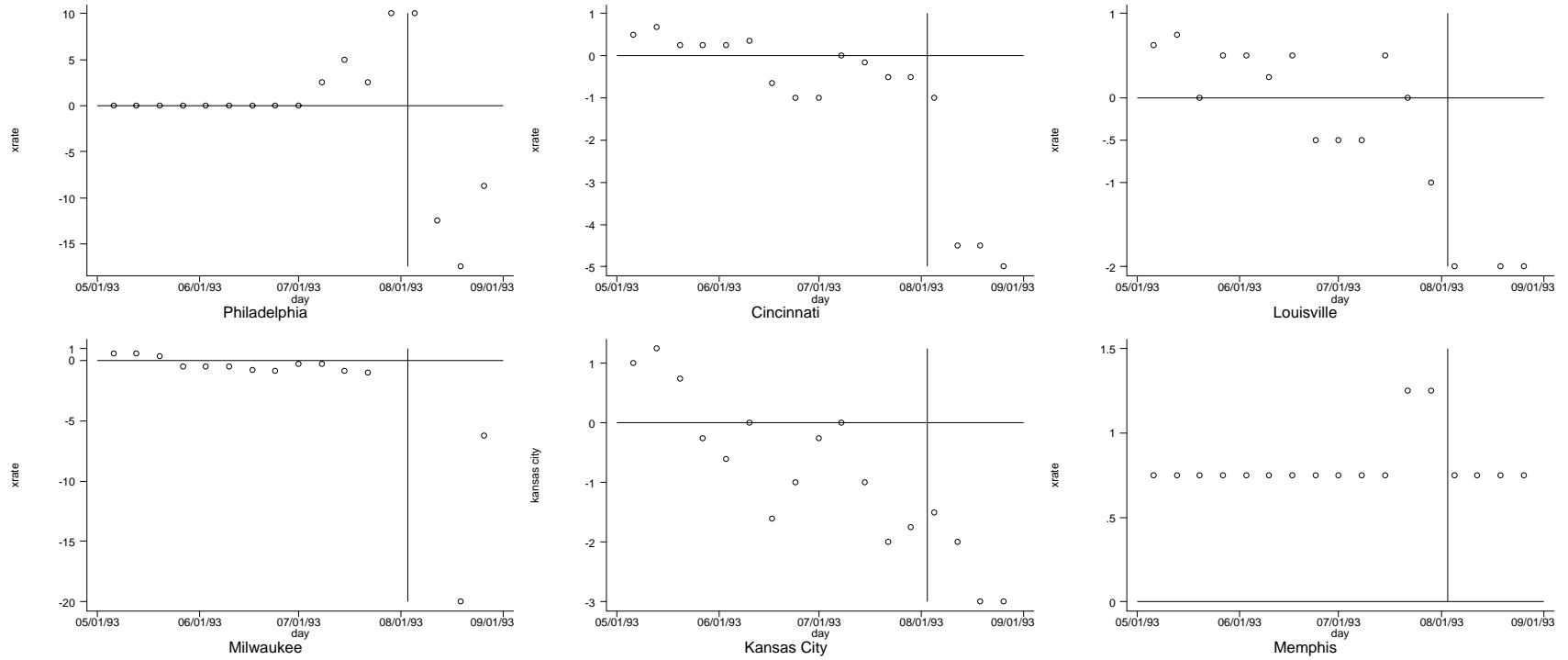


Figure 4: Daily Domestic Exchange Rates in the Panic of 1907

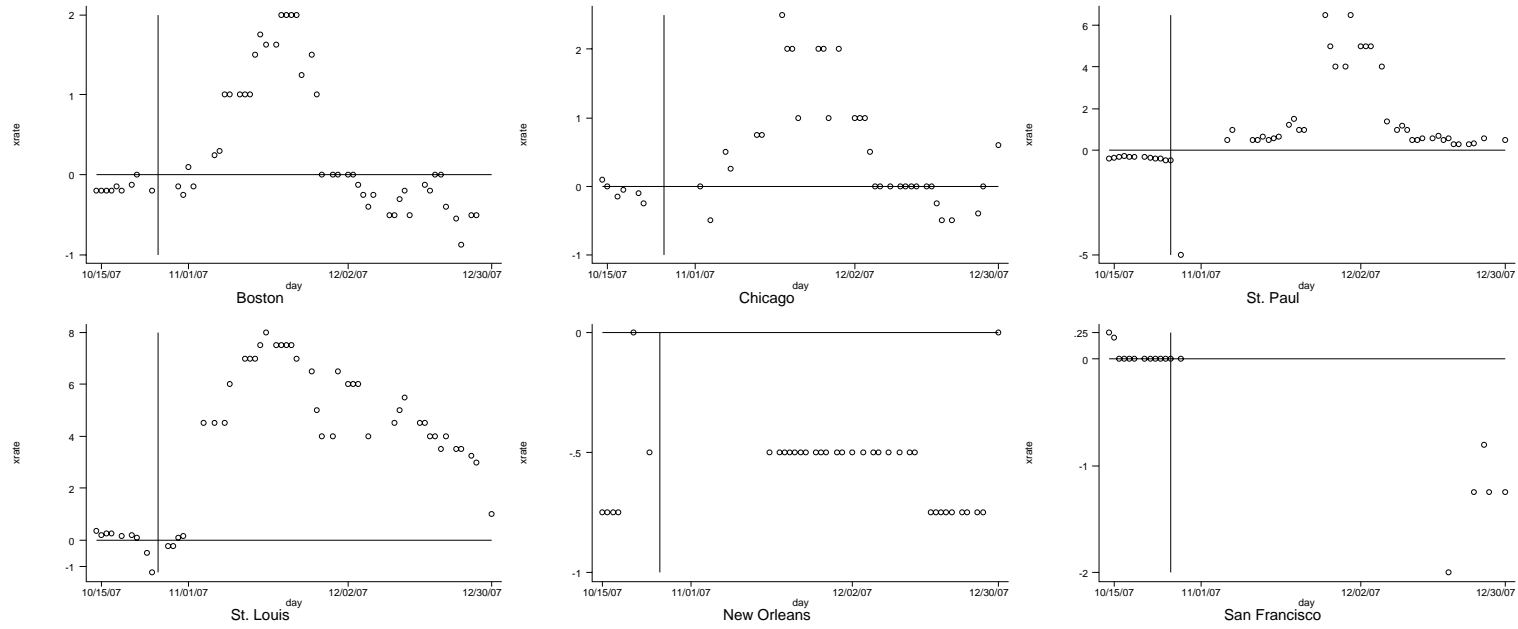


Figure 5: Weekly Domestic Exchange Rates in the Panic of 1907

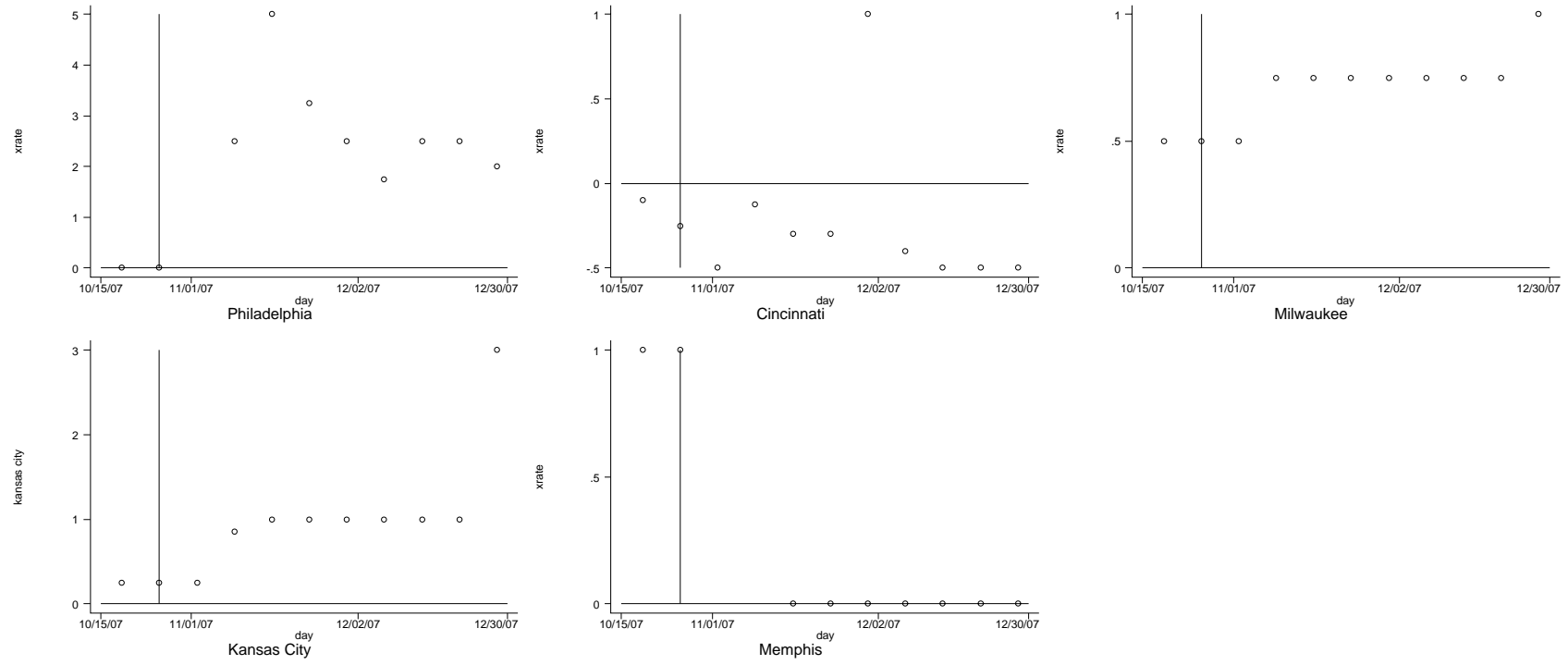
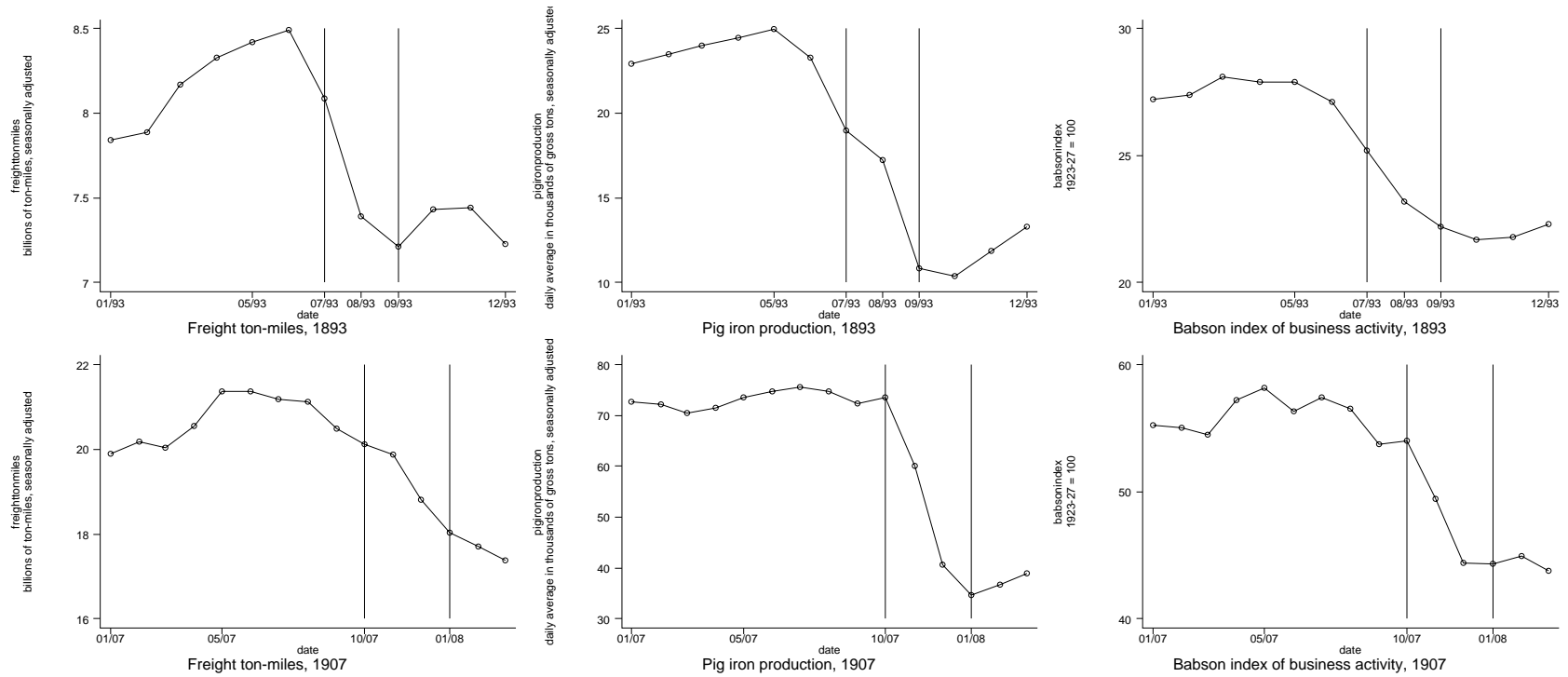
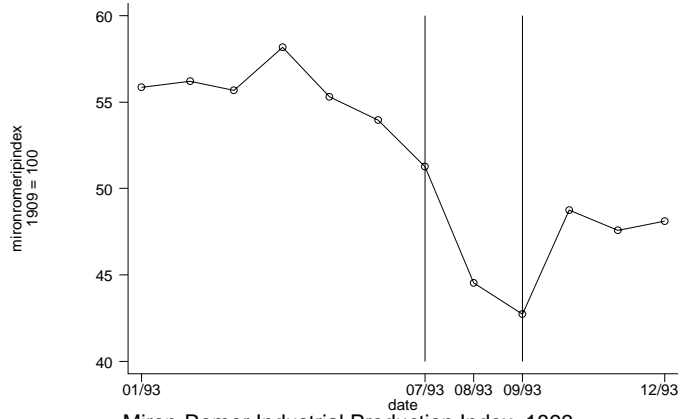
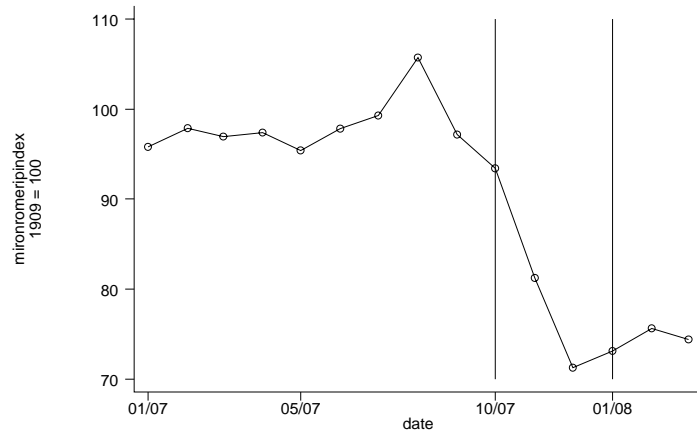


Figure 6: Monthly Indicators of Economic Activity in 1893 and 1907





Miron-Romer Industrial Production Index, 1893



Miron-Romer Industrial Production Index, 1907

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